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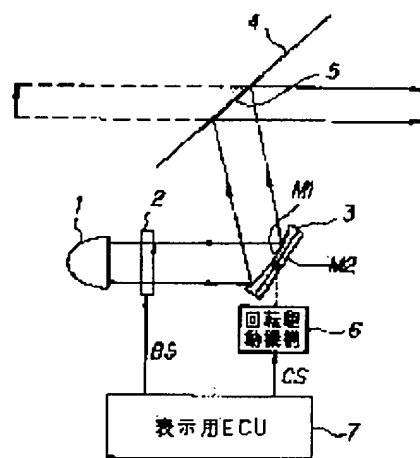
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(54) HEADUP DISPLAY FOR VEHICLE

(57)Abstract:

PROBLEM TO BE SOLVED: To rapidly perform stepwise switching for respective image formation positions set to be distant or close by switching the reflection surface of a reflection mirror having two reflection surfaces consisting of concave surfaces having different curvature or a concave surface and a plane surface.

SOLUTION: The reflection mirror 3 has the reflection surface M1 consisting of a large-curvature concave surface and the reflection surface M2 consisting of a small-curvature concave surface(or plane surface). By rotating the mirror 3 by a rotating and driving mechanism 6, the reflection surface M1 or M2 is selectively positioned at the specified position of an optical system. A displaying ECU 7 is provided as a control system, an image display signal BS is given to an LCD 2 and a rotating instruction CS is given to the mechanism 6 in appropriate timing. When the reflection surface M1 of the mirror 3 is positioned, the image-formation position of the projected image is set to be distant, and when the reflection surface M2 is positioned, it is set to be close.



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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the simple block diagram showing one example of the HUD for cars by this invention.

[Drawing 2] It is drawing showing a way stage of a rotation drive of a reflective mirror with the 2nd page for switching the far and near image formation location in this example.

[Drawing 3] It is drawing showing other means of a rotation drive of a reflective mirror with the 2nd page for switching the far and near image formation location in this example.

[Drawing 4] It is drawing showing the projection condition of an image when the image formation location in the front of a windshield is set up in the distance.

[Drawing 5] It is drawing showing the projection condition of an image when the image formation location in the front of a windshield is set as near.

[Drawing 6] It is drawing showing a way stage of a rotation drive of a reflective mirror with the 3rd page for switching a far and near image formation location.

[Drawing 7] The image of the arrow head for induction directions, such as right and left turn, is drawing showing the condition of having copied out on the long distance image formation location set up so that it might double with the focus of the eyes of the operator who sees the front during transit.

[Drawing 8] It is drawing showing the condition that the image of the simple induction path display for navigation copied out on the image formation location near the front of a windshield at the time of a halt of a car.

[Description of Notations]

- 1 Light Source
- 2 LCD
- 3 Reflective Mirror
- 4 Windshield
- 5 Combiner
- 6 Rotation Drive

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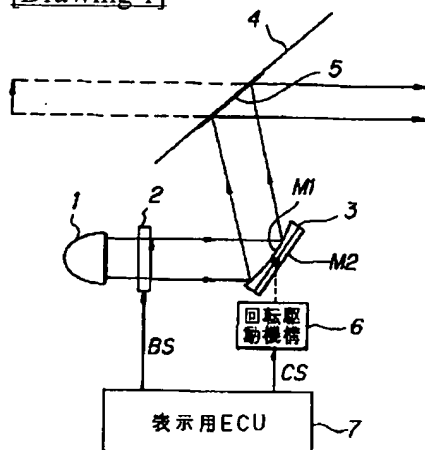
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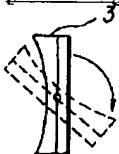
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DRAWINGS

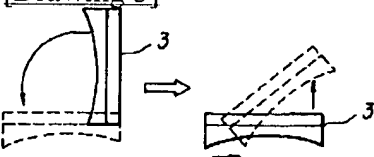
[Drawing 1]



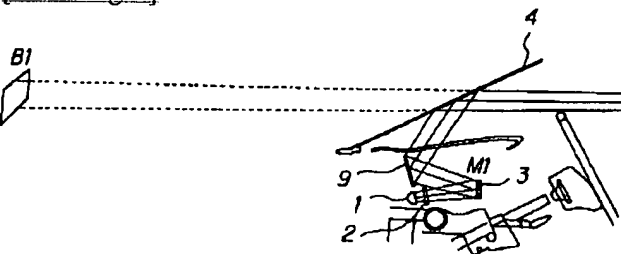
[Drawing 2]



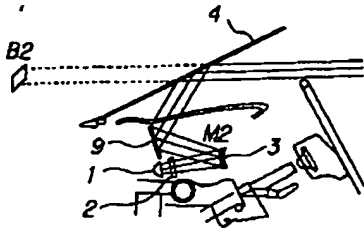
[Drawing 3]



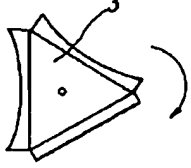
[Drawing 4]



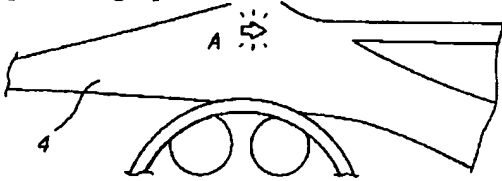
[Drawing 5]



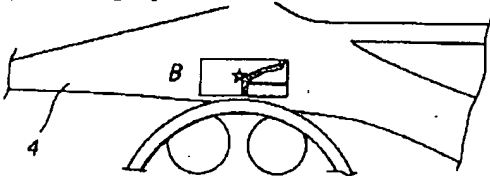
[Drawing 6]



[Drawing 7]



[Drawing 8]



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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the HUD for cars which projected the image copied out on the display screen ahead of the windshield of a car.

[0002]

[Description of the Prior Art] After projecting conventionally the image which is in this kind of HUD for cars, and was copied out on the screen of a drop through an image formation lens By making it the structure which can move a drop on the optical axis over an image formation lens, and changing the distance between a drop and an image formation lens The thing to which enabled it to make far and near adjustment of the image formation location of the image projected ahead of the windshield of a car perform is developed (refer to JP,5-147456,A).

[0003]

[Problem(s) to be Solved by the Invention] When the image formation location of the image projected is set up in the distance so that it may face projecting the image copied out on the display screen ahead of the windshield of a car through an image formation lens or a concave mirror and may double with the focus of the eyes of the operator who sees the front during transit, an image will be expanded, a pixel becomes coarse, and a projection image becomes indistinct, for example, it becomes impossible to see the detail of the road map for navigation etc. Moreover, the road map etc. will stop being able to lap with the scene of a forward-viewing community easily. therefore, an image in that case with easy arrow head for induction directions, such as right and left turn, figure for a rate display, etc. -- projecting -- **** -- it will stop being suitable

[0004] Although a pixel becomes dense, an image becomes clear and the detail of a road map etc. can be seen if the image formation location of the image projected is set as near, it will stop moreover, suiting the focus of the eyes of the operator who sees the car front.

[0005] therefore, in order to copy out various images on a HUD The image formation location where easy images, such as an arrow head for induction directions, such as right for navigation and left turn, are projected at the time of transit of a car so that it may double with the focus of the eyes of the operator who sees the front is set up in the distance. It is necessary to set as near the image formation location where complicated images, such as a road map for navigation, are projected at the time of a halt of the car which ends even if it does not see the front.

[0006] By making it make the setting change of the image formation location of the image projected ahead of the windshield of a car like before by the so-called zoom function to change the distance between a drop and an image formation lens, in that case perform The change to the image formation location set as the ** and ** will not be able to be made to perform quickly, when an image fades and a car stops especially until positioning was carried out, the road map for navigation etc. will not be able to be seen in an instant, but it will cause unarranging.

[0007]

[Means for Solving the Problem] This invention is in the HUD for cars which projected the image copied out on the display screen ahead of the windshield of a car through the reflective mirror. To make it make the gradual change to each image formation location set as ** and ** perform quickly While giving two reflectors which consist of two reflectors or concave surfaces, and flat surfaces which become said reflective mirror from the concave surface from which curvature differs at least He establishes the rotation means which switches the reflector of the reflective mirror, and is trying to make ** of the image formation location of the image

projected ahead of a windshield, and the change of ** perform by switching the reflector of a reflective mirror.
[0008]

[Example] Drawing 1 is what shows one example of the HUD for cars by this invention. The light source 1 and LCD2 on which the optical network projects an image fundamentally, The reflective mirror 3 in which the projected image is reflected, It is constituted by the combiner 5 as a reflecting plate of the light transmission nature prepared in the part of the windshield 4 reflected so that an operator can see the image through the reflective mirror 3 ahead of the windshield 4 of a car.

[0009] In addition, you may make it use the part as a combiner, as the optical interference film is formed in a part of windshield 4, without forming a combiner 5 separately. Moreover, you may make it reflect an image directly by windshield 4 the very thing, without using especially the combiner 5.

[0010] the reflector M1 where it consists of a concave surface with big curvature as a reflective mirror 3, and the reflector M2 which consists of a concave surface with small curvature (or flat surface) -- **** -- it gets down, and the reflective mirror 3 can be rotated and the predetermined location of an optical network can be made to position reflectors M1 or M2 alternatively with the rotation drive 6 now

[0011] You may make it make it reversed, making the reflective mirror 3 slide with a sliding mechanism (not shown) besides rotating the reflective mirror 3 centering on the fixed revolving shaft 8, as shown in drawing 3 as the reflective mirror 3 is shown in drawing 2 as a means which carries out a rotation drive. When making it reversed, making the reflective mirror 3 slide, space-saving-ization is attained as compared with the case where the reflective mirror 3 is rotated.

[0012] Moreover, while ECU7 for a display is formed as the control system and giving the status signal BS of an image to LCD2, the rotation command CS is suitably given to the rotation drive 6 with timing.

[0013] Thus, if it is in some which were constituted and the reflector M1 of the reflective mirror 3 is positioned by the position of an optical network as shown in drawing 4 $R > 4$, the image formation location of the image B1 projected as a virtual image ahead of a windshield 4 will be set up in the distance.

[0014] Moreover, if the reflector M2 of the reflective mirror 3 is positioned by the position of an optical network as shown in drawing 5, the image formation location of image B-2 projected as a virtual image ahead of a windshield 4 will be set as near.

[0016] As an image projected as a virtual image ahead of a windshield 4, the image B1 by the reflector M1 where curvature is big is expanded rather than image B-2 by the reflector M2 where curvature is small, and it becomes large.

[0017] In addition, drawing 4 and drawing 5 show the case where still more nearly another reflective mirror 9 is formed in the optical network. The reflective mirror prepared in an optical network should just use the reflective mirror 3 which there ***** and had two reflectors M1 and M2 for any of them being. [how many]

[0018] moreover, if it be make to make the predetermined location of an optical network position each of that reflector alternatively using reflective mirror 3' of many sides with two or more concave surfaces and 3rd [or more] pages of a flat surface which have a mutually different curvature as show in drawing 6, the image formation location of the image project as a virtual image ahead of a windshield 4 can be make to set it as a multistage story.

[0019] It is in the HUD for cars now constituted as shown in drawing 1, and the actuation at the time of making it display the image of the road map for navigation and images, such as an arrow head for induction directions, such as right and left turn, by turns is explained below, making the reflective mirror 3 switch suitably under control of ECU7 for a display according to whether a car is in a run state, or it is in a idle state.

[0020] ECU7 for a display reads the speed signal v from the speedometer of a car, and detects whether a car is in a run state, or it is in a idle state. When having detected that a car is in a run state, ECU7 for a display obtains the image information for the induction directions at that time from navigation equipment (not shown), gives the status signal of the image to LCD2, and copies out images, such as an arrow head for induction directions, such as right and left turn. And ECU7 for a display gives a rotation command to the rotation drive 6, and the reflector M1 of the reflective mirror 3 is positioned by the position of an optical network.

[0021] When a deer is carried out and a car is in a run state, as shown in drawing 7 With the condition of having seen the front so that it may be projected on the long distance image formation location set up so that the image A of the arrow head for induction directions, such as right and left turn, might double with the focus of the eyes of the operator who sees the front during transit and an operator may secure an operation field of view The image A can be seen without changing the focus of an eye in any way. In addition, in order to attract an

operator's attention, a flashing indication of the image A of the arrow head for induction directions, such as the right and left turn, is given.

[0022] Moreover, a car obtains the image information of the road map of the predetermined area where the current position of the self-vehicle at that time is displayed from navigation equipment (not shown), when a idle state is detected, and it gives the status signal of the image to LCD2, and ECU7 for a display copies out the image of the road map for navigation. And ECU7 for a display gives a rotation command to the rotation drive 6, and the reflector M2 of the reflective mirror 3 is positioned by the position of an optical network.

[0023] Drawing 8 shows the image B when performing the simple induction path display for navigation copied out at the time of a halt of a car.

[0024] When a deer is carried out and a car is in a idle state, it can be projected on the image formation location where the image of the road map for navigation was set as near, and an operator can see the detail of the road map.

[0025] In that case, a switch with images, such as an arrow head for induction directions, such as right projected on a long distance image formation location and left turn, and the image of the road map for navigation projected on a nearby image formation location can be performed by rotation of the reflective mirror 3 in an instant, and an operator can see the road map for navigation now clearly from the moment the car stopped especially.

[0026] Moreover, when this invention makes a display image switch according to ** of the image formation location in the front of a windshield 4, and **, For example, as the operator from navigation equipment who does not illustrate shows under control of ECU7 for a display at drawing 7 according to the input indication signal of the purport which is elderly people, the right where the contents of a display are easy ****-wise, left turn, etc. display the image A of the arrow head for induction directions on a long distance image formation location. And in the case of the healthy person whose operator is not advanced age, as shown in drawing 8, it is possible to make it also make the image B of the simple induction path display for navigation with the comparatively complicated contents of a display perform in a nearby image formation location.

[0027]

[Effect of the Invention] As mentioned above, according to the HUD for cars by this invention, the gradual change with the time of making an image project on the image formation location of the time of making it project on a long distance image formation location and near can be made to perform in an instant, and the image projected on ** and ** from the beginning on the occasion of the change can be vividly seen now.

[0028] Moreover, it is made to project so that it may double with the focus of the eyes of the operator who sees the front while a car runs the easy images for the induction directions for navigation, or a rate display etc. during transit according to this invention. Various images, such as making it make complicated images, such as a road map for navigation, project on the location of near which can see the detail etc., when a car stops, can be suitably displayed now on the optimal location of ** and ** according to the contents.

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CLAIMS

[Claim(s)]

[Claim 1] In the HUD for cars which projected the image copied out on the display screen ahead of the windshield of a car through the reflective mirror While giving two reflectors which consist of two reflectors or concave surfaces, and flat surfaces which become said reflective mirror from the concave surface from which curvature differs at least The HUD for cars characterized by establishing the rotation means which switches the reflector of the reflective mirror, and making it make the far and near change of the image formation location of the image projected ahead of a windshield by switching the reflector of a reflective mirror perform gradually.

[Claim 2] An image comparatively easy when it is detected a means to detect whether a car is in a run state or it is in a idle state, and that it is in a run state is projected on the image formation location set up in the distance. The HUD for cars by the publication of said 1st term characterized by establishing the means for switching of the image which projects an image comparatively complicated when it is detected that a car is in a idle state on the image formation location set as near.

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